THE SECRETARY OF HEALTH AND HUMAN SERVICES
WASHINGTON, D.C. 20201

DEC 19 1996

The Honorable Reed E. Hundt
Chairman
Federal Communications Commission
1919 M Street, N.W., Room 814
Washington, D.C. 20554

Dear Mr. Hundt:

The U.S. Department of Health and Human Services (HHS) is pleased that the 1996 Telecommunications Act recognizes the potential of advanced telecommunications to improve the health of Americans. We are all proud of the many advances in our health system in recent decades: innovations in preventing, diagnosing, and treating disease are keeping Americans healthier, longer. Telehealth applications can help us strengthen many of the activities that make this progress possible.

- Health care providers can be linked to each other, to health facilities, and to valuable sources of medical information to do their work better. They can get continuing education from distant institutions. They can also be linked to patients in their homes in order to monitor their progress.

- Our public health departments can track emerging diseases and share vital information with health professionals and officials around the world and target public education campaigns to prevent behaviors that are risks to health.

- Individuals can be linked via the Internet to their doctors, to interactive health education programs, and to the vast global database of health information that was previously reserved for professionals. They can be connected to others who share their health concerns. This can help them take an active responsibility for their own health and medical care.

I am enclosing a document, entitled "Value of Telecommunications Services for Health Priorities," that gives examples of these benefits.

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Unfortunately, these benefits are not shared equally. People living in underserved areas, primarily rural, often carry the double disadvantage of heavier health burdens and less access to advanced telecommunications. Using the Universal Service Fund to address the telecommunications cost disparities between urban and rural areas could help improve both health care delivery and the health status of these Americans.

HHS believes it is especially important to support Internet access at local calling rates for rural health care providers. We also urge the FCC to allow providers to choose telecommunications services up to the 1.544 Mbps ceiling for any health-related application the provider determines to be necessary. HHS also believes that the elimination of distance charges is vital to help make advanced services affordable.

It is important not to focus too narrowly on "telemedicine" applications, which refer to medical care and especially consultative services by subspecialists. We would like to see explicit recognition of other public health services that support health care. These services are described in an enclosed documents entitled "The Role of Public Health in Prevention and Medical Care" and "Making a Powerful Connection: The Health of the Public and the National Information Infrastructure." To help avoid ambiguity, we suggest that the FCC adopt the broader term "telehealth," which encompasses telemedicine and other health-related applications.

Our specific recommendations on these and other issues are given in greater detail in the enclosed document entitled "HHS Response to FCC Public Notice on Universal Service." The telecommunications cost data that we have been able to gather are also enclosed. Any further data will be sent as an amendment to this response during the Reply Comment period.

Under a very tight timetable, the FCC has accomplished a great deal. We look forward to working with you to improve the health status of all Americans through the implementation of the 1996 Telecommunications Act and future legislation. I am sending a similar letter to all FCC Commissioners.

Sincerely,

Donna E. Shalala

# RESPONSE TO FCC PUBLIC NOTICE ON UNIVERSAL SERVICE
## CC Docket 96-45

### U.S. Department of Health and Human Services
December 19, 1996

## LIST OF ENCLOSED MATERIALS

1. Detailed Response to Public Notice

2. Value of Telecommunications Services for Health Priorities

3. The Role of Public Health in Prevention and Medical Care

4. Making a Powerful Connection: The Health of the Public and the National Information Infrastructure

5. Illustrative Examples from a Selection of [HHS Centers for Disease Control and Prevention] INPHO Grant States: Report on 12 Question Survey on Telecommunications

6. Data from HHS Office of Rural Health Policy Telemedicine Grantees

# RESPONSE TO FCC PUBLIC NOTICE ON UNIVERSAL SERVICE
## CC Docket 96-45

### U.S. Department of Health and Human Services
December 19, 1996

1. Advisory Committee Recommendations.

The U.S. Department of Health and Human Services (HHS) believes that the recommendations of the FCC's Advisory Committee on Telecommunications and Health Care which are particularly important are: supporting Internet access at local calling rates for rural health care providers; support for bandwidths high enough for a wide range of activities, including accessing the Internet, transmitting high-quality images, and delivering fully interactive video; allowing providers to choose telecommunications services up to the 1.544 Mbps ceiling for any health-related application the provider determines necessary; and supporting infrastructure upgrades, where necessary, to provide the desired services.

We do not think that the FCC need worry that the inclusion of these provisions will generate tremendous demand for sophisticated telecommunications services. Rural health providers and health departments have very limited budgets. They are likely to be extremely cost conscious about what services they order. On the other hand, we would like to see the ceiling set high enough so that those who can benefit from more advanced telecommunications services will be able to obtain whatever services they feel are needed at rates comparable to those in urban areas.

2.    Review Cycle

We prefer the two-year review cycle recommended by the Committee rather than the year 2001 review recommended by the Joint Board. The health sector is evolving as rapidly as telecommunications. The focus is moving away from acute, specialty care toward primary and preventive care; and away from hospitals to out-patient and extended care facilities--and, most dramatically, toward the home. With the goal of reducing unnecessary utilization of medical services, greater emphasis also is placed on the public health infrastructure to support personal and community health and on the role of the well informed individual and family in sound health decision-making. It will be important to reassess the "market basket" of essential applications in light of these developments and concurrent improvements in telecommunications.

We would suggest that the review take into account information that will be available in approximately 18 months from an evaluation of rural telemedicine by the HHS Office of Rural Health Policy. This data can inform FCC policy so that the most

cost-effective decisions can be made regarding the subsidies. To wait until 2001 for revisions of FCC policies could risk keeping in place provisions that do not reflect the current reality of rural activities.

Another reason we support the shorter review cycle is that we would like it to be completed before the end of a new three-year telemedicine demonstration sponsored by the Health Care Financing Administration. A major goal of this demonstration is to determine if or how Medicare should cover such services. It would be very helpful if the nature and extent of a subsidy for health-related telecommunications were reviewed and any changes made before the end of HCFA's demonstration,allowing for appropriate data to be gathered and reviewed as HCFA develops a telemedicine coverage policy. Such a subsidy could affect not only what HCFA may determine as appropriate compensation for telemedicine providers, but also the scope of coverage and determination of when or how telemedicine is cost-effective for Medicare or Medicaid.

3.      Inadequacy of Public Notice Comment Period.

It is impossible to obtain comprehensive, generalizable telehealth cost data in the time allowed. While HHS is pleased to provide some data from its own grantee networks and has encouraged other health agencies and organizations to submit available data, we feel that additional data gathering efforts should be undertaken during the review cycle. We would be happy to work with FCC staff on this.

4.      Definition of Scope of Services

HHS feels that the Advisory Committee's focus on "telemedicine" is insupportably narrow. The Act specifically addresses telecommunications services that "are essential to...public health...," and public health departments are included in the definition of health care provider in the Rural section. "Telemedicine" is a term applied to telecommunications services related to the delivery of medical care and especially to consultative services by subspecialists. As noted in our attachments, rural health departments and agencies engage in a wide array of non-medical activities in support of health care. HHS would therefore ask that the FCC's Final Order include a specific finding that defines "rural health care provider...[including] public health departments" as including all sites of rural health departments and agencies, not only those that deliver medical care on the premises. We interpret the Act to allow support for "telecommunications services necessary for the provision of health care" to include services linking these public health departments and agencies not only to urban medical centers but with each other and other health care providers, schools of medicine and public health, and also public schools. We would also like the Final Order to include a specific finding that defines "telecommunications services necessary for the provision of health care services in a state (including instruction)" as including

the transmission of preventive health data, reports of epidemiological investigations, guidelines for the delivery of preventive services, training materials, and emergency notices; professional teleconsultation with two-way interactive audio and video; access to health data and information via the Internet; and multi-point consultation for health emergencies. HHS suggests that FCC adopt the broader term "telehealth" to indicate inclusion of these applications as well as telemedicine applications, which can be viewed as a subset of telehealth.

5.    Distance Insensitive Rates

HHS urges the FCC to establish rates that address the impact of distance. Telecommunications carriers frequently set rates based on a per mile basis. So even when the per mile charges are the same, rural providers may be paying 10-20 times more for the same services because of the great distances involved.

6.    Gaps in 1996 Legislation

HHS is concerned that low income, urban populations also lack access to the benefits of advanced telecommunications. These people have disproportionate levels of illness, injury, and premature death. We support the Advisory Committee's recommendation that FCC and Congress investigate whether incentives for the development of telehealth applications in underserved urban areas would be appropriate.

HHS also notes that most rural health care is provided by small for-profit institutions and individuals. If they do not utilize telehealth applications, rural areas will not gain the desired benefits. While we understand that the intent of Congress was clearly not to subsidize for-profit providers, we encourage the FCC to explore this issue further.

# Value of Telecommunications Services for Health Priorities

## 1. Linking Health Care Providers

- Continuing Education - All health care providers are challenged by the need to remain current with changing medical practice technology and knowledge. Providers will be attracted to and will stay in those communities where access to continuing education information is available. Bandwidth from basic ISDN (56-128 kb/s) to full T-1 (1.544 mb/s) is sufficient to participate in most distance learning networks in operation today. CDC's Public Health Training Network broadcasts programs weekly related to a wide array of preventive services. Many academic education centers are beginning to also provide distance-based continuing education with Grand Rounds and other educational fora of wide interest.

- Providing Patient Care and linking patients to providers for continuity of care - Providers in private and public clinics need to be linked to one another and to their patients to improve continuity of care and to influence health practices. Low bandwidth applications such as E-mail have already been shown to significantly aid this practice.

- Consultation and expert advice - Through provider to provider and provider to public health linkage providers need to have access to expert advice and to share experience with one another. Coordination among rural providers is particularly important because they often lack the opportunity to see colleagues in the course of daily business. Connection to Internet for E-mail and access to important sources of expert information is practical today at 56kb and greater bandwidth.

- Emergency notification - E-mail (low bandwidth) and video conferencing (1.5mb) has proven to improve coordination among providers in emergency situations. Telecommunications technologies, such as E-mail, are increasingly used to improve response to outbreaks of drug resistant organisms through emergency alerts directly to providers.

- Disaster response - Extensive coordination through E-mail (low bandwidth) extending up and including video conferencing capability (1.5mb) assists coordinating many providers during crisis and emergency situations. The Georgia Information Network for Public Health Officials was the most extensively used communications medium during the 1995 flooding of south Georgia. Similarly, CDC WONDER was used by the Iowa State Health Department to coordinate activities during the Mississippi River floods of 1994. Keeping public and private providers in contact with one another is possible through E-mail at low bandwidths and provides highly valuable service to the public.

- Connecting isolated, fragile and elderly populations from home for consultation and care - Personal face-to-face consultations will improve patient adherence with treatment regimens and reduce high cost encounters at health care facilities. This application will

require interactive video at (1.5mb).

- Connecting health care providers with the educational system - By being able to interact with the educational system via the Internet, private and public providers can provide education and consultation. Discussion forums, Ask-the-Expert sessions, and mediated guidance sessions are possible using E-mail (low bandwidth) and can range to interactive sessions using high bandwidth (1.5mb).

- Specialty care and consultation to rural patients - Providing high bandwidth communications provides access to special expertise for diagnostic services, expert consultations, and follow up patient care. Most of these telemedicine applications require partial to full T-1 service.

## 2. Tracking Emerging Diseases

- Identifying pockets of emerging diseases - Telecommunications at low bandwidth is needed to create awareness, provide timely information regarding newly detected outbreaks of drug resistance in a local region, and to offer access to "disease weather maps" that are being developed for display to providers over the Internet.

- On-demand access to expert information - Numerous sources of expert information are developing today on the Internet. Information ranging from cancer diagnosis and treatment to the complete compendium of CDC Prevention Guidelines can be accessed today on the Internet via the World Wide Web. Satisfactory access requires minimum bandwidth (56kb) but is enhanced at rates around 384kb.

## 3. Linking the Public to Information Resources

- Empowering K-12 education through access to preventive health practices information - Increasingly, educators and students are seeking access to a wide array of information directly from through the Internet. Important community sources of information such as health departments can provide that information and offer interaction via the Internet at low bandwidth rates (56 - 128 kb).

- Informed choice and personal decision making - As citizens seek to make more informed decisions about preventive health practices and seek to gather information to help them make medical treatment choices, providers will need to have a more rich, timely and accurate set of information available for them. WWW access will be essential.

- Learning about protecting against significant risk factors - The academic, federal and state public health agencies and voluntary organizations that generate risk factor and preventive practices information are all targeting this towards WWW format. Citizens in rural areas will need access to this.

**The Role of Public Health in Prevention and Medical Care**

Thirty years have been added to life expectancy of United States residents since the turn

of the century. Of all the statistics, program achievements, and individual successes that relate

the importance of public health, the most telling may be a recent estimate that only 5 of these 30

years have been added by improvements in medical care. The majority of the gains have come in

areas that are the focus of public health: improvements in nutrition, sanitation, and safety. Public

health is best defined by what it does. It educates people about healthy lifestyles, including diet,

exercise, safety, and substance abuse. It monitors and controls infectious diseases by tracking

disease, controlling outbreaks, and promoting immunizations. It researches the cause of disease

and injury, searches for effective interventions, implements interventions and monitors the

interventions' success.

Through these activities public health improves the quality of life. It reduces illness and

the associated pain and discomfort, it reduces disability, and it prevents death. In addition,

public health reduces the financial burden of health care. Prevention is the overriding objective

of public health activities; prevention has its merits not only in improving the quality of life but

also in reducing the resources that are needed to maintain the population's health. Disease

prevention and health promotion are gaining a great deal of attention as government, industry,

and the health care sector look for ways to stem the growth of our nation's health care costs.

Those who are seeking means to reduce medical costs are looking for effective ways to inform

citizens about health risks, and to empower them to take a positive role in their own health

maintenance and treatment.

This is especially important in rural areas, where residents are older, on average, and

where they face greater risks from certain injuries (for example, approximately two-thirds of

motor vehicle deaths occur in rural areas). If rural residents are injured or become ill, they must

drive longer distances to doctors and hospitals for treatment. Rural residents have recently found

themselves traveling longer distances to regional health care centers, without the benefit of a

public transportation system. Additionally, the physical barriers to health care access may be

less of an obstacle than the financial barriers. In 1992, one out of every six rural families lived in

poverty, compared to one out of every eight in urban areas; rural residents below the federal

poverty level were less likely to be covered by Medicaid than urban residents. Not surprisingly,

many rural residents go without treatment or preventive care until their condition becomes

critical: a disproportionate number of rural residents suffer from chronic illnesses.

Application of telecommunications to rural clinical and preventive health care and health

professions education can help overcome the isolation of rural practitioners and play a significant

role in building rural networks of public health care. In a 1992 study, Arthur D. Little, Inc.

estimated that the effective use of telecommunications could help the United States reduce its

health care bill by more than $36 billion per year. Access to telecommunication technology can

bring rural health departments sound economic perspectives on guiding public health decision

making and resource allocation. It can provide extensive information on ways that rural public

health can improve on the efficiency and cost-effectiveness of its planning and delivery.

There is a multitude of examples of public health interventions that are applicable to, and

deliverable by rural health departments and health care providers that directly improve

community health. These interventions demonstrate the cost savings and the improvements to

the quality of life that can result when they are efficiently and effectively planned and delivered.

Many of these examples consider the potential of savings from averted medical costs alone. The

true savings from public health activities are much greater due to increases in productivity and

other illness-related costs borne by patients.

(1) **Immunization/Vaccination** against childhood disease is one of the most cost-effective health interventions available. For example, the MMR (measles, mumps, and rubella) vaccine saves $16.30 for every dollar invested, while the DTP (diphtheria, tetanus, and pertussis) vaccine saves $6.00 for every dollar invested. A rotavirus vaccine program can save $78 per case prevented in direct medical costs, and $459 per case prevented in direct and indirect costs. Having access to innovative current information from the leading sources in the public health arena on methods of delivering these immunizations can maximize the efficiency and cost-effectiveness of local immunization programs. For example, improved immunization record keeping at family practice clinics can provide a better awareness of rural immunization rates and can facilitate more effective delivery of immunizations.

(2) **Injury** is the leading cause of death for children, as well as the leading cause of childhood medical spending. The Injury Prevention Program (TIPP), developed by the American Academy of Pediatrics, consists of counseling by physicians to educate the parents of young children on child safety issues. At a cost of $69 per child for the program, TIPP saves $880 per child in future medical spending, work loss, and quality of life. Rural health departments can incorporate the TIPP into their primary care programs and can educate other community health providers such as family practice practioners and school-based clinics on the value of the program and eventually recognize cost savings.

(3) Low birth weight is a major public health problem in the United States. It is the principal determinant of infant mortality and a leading cause of childhood illness. The Office of Technology Assessment estimates that low-birth-weight births cost from $14,000 to $31,000 more than normal birth-weight births. Early and adequate **prenatal care** is effective in preventing low birth weight, especially among members of high-risk medical and socioeconomic groups. In particular, pregnancy in

diabetic women can be accompanied by a number of maternal and fetal complications. Approximately 20% of white mothers and 40% of black mothers receive no prenatal care during the first trimester of pregnancy. For every dollar spent on providing prenatal care to low-income, poorly educated women, about $3 is saved in expenditures for direct medical care during the infant's first year of life. For women of childbearing age with diabetes, incorporating a **preconception component** to an already existing prenatal care would save an additional $1,720 in preventing maternal and fetal complications. For every $1 spent on a preconception-care program, approximately $1.86 could be saved in complications averted.

(4) Ten to fifteen million people are infected with **tuberculosis** in the United States. The incidence of TB has been increasing in recent years, with blacks and Hispanics disproportionately affected. The average cost of caring for a patient with TB is approximately $20,000 per year. Programs to prevent cases of TB by screening high-risk kindergartners and high school entrants, followed by treatment with INH, would save $1.20 for every $1.00 spent.

(5) Despite the efficacy of **influenza** vaccination in preventing complications of influenza, rates of immunization among high-risk populations remain low, especially among the elderly and those living in rural communities. Through a coordinated community-wide program, a collaborative approach can succeed in achieving high rates of influenza immunization. Increasing an immunization rate of 45 percent to 57 percent among the elderly can increase direct savings per year from $21 to $235 per vaccinated person.

(6) In 1993, 600 people were affected by an **E. Coli** outbreak in the state of Washington. Forty five experienced acute kidney failure and 3 children died. The probable source of the infection was identified and removed five days after a physician reported a potential outbreak to the local health department. The

medical costs of this outbreak were estimated at $1 million. The medical costs may have exceeded $2 million had the source of infection been identified 10 days later. Electronic access to the latest food- and waterbourne outbreak reports from CDC improves the rural health department's ability to prevent outbreaks from spreading by monitoring for new cases of disease.
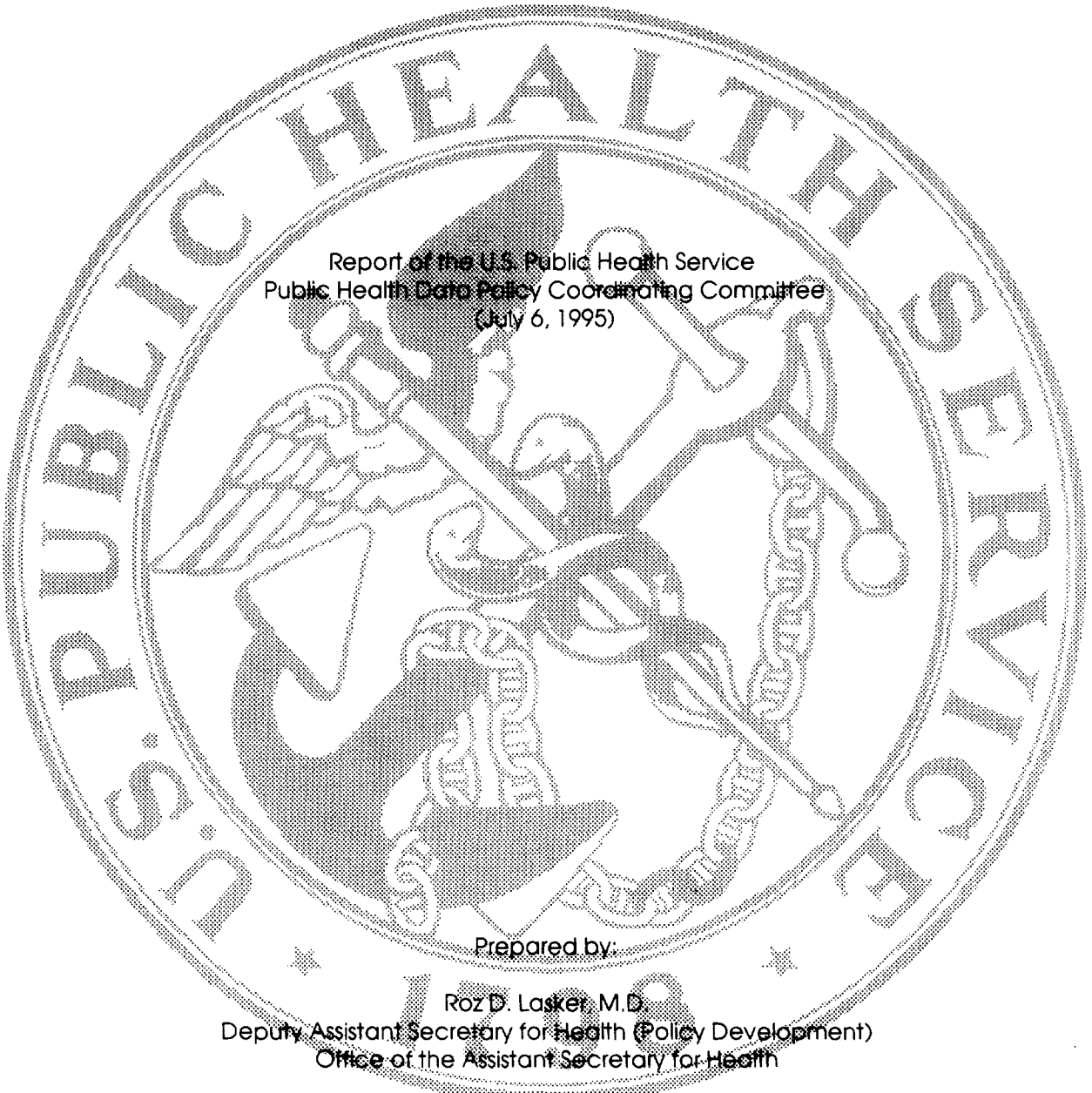
(7) Rural health departments also identify local **occupational hazards**. Combining the rate of decrease in occupational fatalities between 1980 and 1989 with conservative estimates of projected occupational fatalities through the year 2005 indicates that 80,000 lives and $1.5 billion in medical costs could be saved through public health interventions over a 25 year period.

(8) A major public health challenge of the 20th century has been and continues to be sexually transmitted diseases (STDs). The rate of STDs in the United States is the highest in the industrialized nation. Local public health deparments prevent and control the spread of STDs through monitoring, organizing prevention activities, partner notification, developing standards of care, and conducting outreach to encourage individuals to adopt safer sexual behaviors. It costs $2.1 billion a year to treat women for the consequences of a prior untreated chlamydial infection, for example, including ectopic pregnancy, PID, and infertility; screening and preventive treatment costs $175 million a year. The annual savings from prevention: $1.9 billion. Without continued support and expansion of the public health role in STD prevention, the numbers of new cases will increase, leading to the increased cost of treating medical complications.

(9) Poor children have a significantly higher risk of **mental retardation** than children from

families of higher socioeconomic status. However, an intensive health and development program can prevent approximately two-thirds of poverty-associated mental retardation or borderline intelligence among high-risk children. Early early childhood intervention programs to prevent poverty-associated mental retardation can save an estimated $5.73 for every dollar invested in the programs.

# MAKING A POWERFUL CONNECTION:
# THE HEALTH OF THE PUBLIC AND THE NATIONAL INFORMATION INFRASTRUCTURE

Report of the U.S. Public Health Service
Public Health Data Policy Coordinating Committee
(July 6, 1995)

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the public health community with an opportunity to obtain funding for projects that apply NII technology to population health. However, while it is encouraging that a small number of public health applications have been funded through broad-based NII grants sponsored by the federal interagency High Performance Computing and Communications program, the Department of Commerce, and the Department of Agriculture, public health participation in these programs has been modest at best.

Thus far, the bulk of federal support for population-based health applications has come from U.S. Public Health Service (PHS) programs specifically targeted to the public health community. In April 1995, the PHS sponsored a conference at the National Library of Medicine, during which leaders in the NII and population health communities had an opportunity to come together, explain their work to each other, delineate the barriers that currently discourage application of NII technologies to the information problems of population-based public health, and lay out a comprehensive strategy for moving forward. At this conference, the major barriers that emerged, above and beyond basic resource constraints and the limited appreciation by both the public and policymakers of the importance of population-based public health, included:

> a lack of nationally uniform policies to protect privacy while permitting critical analytic uses of health data;
> a lack of nationally uniform, multipurpose data standards that meet the needs of the diverse groups who record and use health information;
> insufficient awareness of the applicability of NII technologies in meeting the information needs of population-based public health;
> a public health workforce that lacks essential information technology skills; and
> organizational and financing issues that make it difficult to integrate information systems or bring potential partners together.

Those attending a strategy session following the conference proposed a strategic plan that capitalizes on what a broad range of actors -- state and local public health agencies, federal agencies, professional associations, educational institutions, and other groups -- can do individually and together to overcome these barriers. This plan, which should be viewed as one component of a larger public health information strategy, is designed to:

> bring the broad public health community together to develop a comprehensive public health information strategy, including a compelling vision (and specific examples) of how NII technologies can improve population health;
> advance a nationally uniform framework for privacy, data standards, unique identifiers, and data sharing, without which, it is very difficult to implement integrated health information systems;
> bring public health, health care, research, and informatics groups to the table to ensure that privacy of individually-identifiable health information is protected in ways that permit critical analytic uses of health data, and that standards for health data meet the needs of the diverse groups who collect and use health information;
> promote the use of information in public health through legislative initiatives (such as Performance Partnership Grants) that foster accountability for improving population health, overcome categorical barriers, and permit states to use federal funds to develop and maintain integrated health information systems;
> facilitate partnerships between the public health community and other sectors to identify and make progress toward common information goals (including both policy issues and

## 2.0 INTRODUCTION

The NII initiative focuses on enhancing the basic infrastructure for telecommunications and computer technology in all sectors of the U.S. economy. It encompasses economic and regulatory policies to encourage private investment in the NII as well as federal grant funding. From the outset, health has been identified as one of the key sectors that can benefit from better information technology (1). Thus far, however, NII grants related to health have primarily supported applications of high performance computing and telemedicine to the delivery of medical care to individuals. Relatively little attention has been paid, by either the private or the public sector, to applications that would support population health (2). As the information infrastructure is built throughout the United States, it is important to ensure that both medical care and public health requirements are addressed. Information technology offers an opportunity to link the health of populations and the medical treatment of individuals more closely, to the benefit of both.

The PHS is committed to stimulating more vigorous participation of the public health community in the NII initiative, and to bringing those involved in the NII and population health together to articulate and realize a collective vision for harnessing the NII in support of the health of the public. Four components of the PHS -- the National Library of Medicine (NLM), the Office of the Assistant Secretary for Health (OASH), the Centers for Disease Control and Prevention (CDC), and the Agency for Health Care Policy and Research (AHCPR) -- jointly sponsored an invitational conference on this topic on April 19, 1995 and a smaller strategy session on the following day. A first draft of this paper was distributed to those attending the conference to provide a common basis for discussing the NII and public health.

This version outlines the issues that were brought up and discussed at the conference and incorporates the strategic plan that was developed on April 20. It is being disseminated widely, both to audiences seeking to learn more about the potential of the NII to improve the health of the public, and to those who can help make these potential applications a reality.

assure a competent public health and personal health care workforce;

evaluate the effectiveness, accessibility, and quality of personal and population-based health services; and

conduct research to identify new insights and innovative solutions to health problems.

As the health care system increasingly shifts towards a population-based focus, the interests of public health and the health care sector are beginning to converge. With the growth of managed-care plans responsible for defined populations of enrollees, and the emergence of health plan "report cards", the health care system is becoming a more suitable vehicle for achieving certain public health objectives (such as the delivery of clinical preventive services). With payments based on capitation, health plans have an incentive to care about population health because they benefit financially to the extent that either they or the public health system keep their enrollees healthy. And with managed-care plans taking over the care of vulnerable populations, such as Medicaid beneficiaries, public health agencies are becoming responsible for assuring that the enrollees of these plans receive appropriate services. As both the interests and populations-of-interest in these two sectors converge, there is a real opportunity to integrate health promotion and disease prevention into health care delivery. To move in this direction, health care organizations and the public health community will need to coordinate not only their roles and responsibilities, but also their information systems.

Not surprisingly, these same factors are also prerequisites for effective computer-based patient record systems.

## 4.2 Communication

Whether it be through written text, video, radio, e-mail, telephone hotlines, clearinghouses, or other information resources, communication is the sine qua non for informing, educating, and empowering people about public health problems and health issues in general. The targets for public health communications are quite diverse. For example, consumers need to know about personal behaviors that pose risks to health, and where to find services that can support difficult changes in lifestyle. Potential communicable disease contacts need to be informed about risks so that they can seek out diagnosis and treatment. Practitioners need to be alerted to emerging infectious and environmental threats to health so that they can target preventive, diagnostic, and therapeutic services. And the media needs to learn about health problems in the community so that they, in turn, can publish the facts for wider distribution.

Types of communication that actively link people together are also integral to public health. For instance, effective actions to limit the spread of disease, to respond to disasters, or to minimize the risk of injury or death require the ability to communicate information rapidly to many people at diverse sites. Developing workable strategies for addressing community health problems requires systematic ongoing communication and collaboration among widely scattered public health officials, health care providers, elected officials, employers, community organizations, and fire, rescue, law enforcement, social services, school, and library personnel. Addressing problems in remote areas often requires consultation with off- site specialists, such as epidemiologists, civil engineers, or entomologists. The challenges of keeping up-to-date with advances in public health increasingly demand the availability of long-distance learning ("schools without walls").

## 4.3 Support in Decisionmaking

Information is a prerequisite for public health, but it may be perceived more as a curse than a blessing if the expanding base of available information cannot easily be put to use for a specific purpose. Virtually all essential public health services depend on ready access to information about what is known about a particular public health problem and who is doing what in a particular community. For example, diagnosing the cause of an outbreak (such as the recent release of nerve gas in the Tokyo subway system) and identifying effective interventions requires a fast, targeted review of the research literature, identification of available resources and experts, and application of what is known generally to the features of a particular situation.

Practitioners in both the public and private sectors as well as managers of health care organizations need efficient access to the latest disease and disability prevention guidelines and ways to apply them to their patients and populations. Consumers also need help in comprehending the public health literature, not only to obtain information relevant to their individual needs, but also to sort fact from fiction, and to identify local support services that can help them take effective action. Sophisticated tools for displaying and manipulating data are also important in public health, especially for essential services that depend on seeing a pattern in rare events or applying what is known generally to a small region or subpopulation. For instance, the recent Hantavirus outbreak was diagnosed through a CDC medical examiner surveillance database, which showed a clustering of similar deaths among young people in the

## 5.0 WHAT ARE THE GENERIC CAPABILITIES OF NII TECHNOLOGY?

Conceptually, the NII is like a giant electronic web that will allow each user's computer, telephone, and television to interconnect with others, regardless of their location or the distance between them, and will enable each user to communicate with everyone else who is connected to the web. Over this network, public and private information sources and data processing utilities will be able to transmit, store, process, and display information in many forms (such as data, voice, and images) and provide information retrieval and processing services on demand, as if connected in the next room.

Technically, the NII is the logical convergence of computer hardware, software, and networking technologies made possible by the increasing digitization of text, sound and images. The basic technologies underpinning the NII include very high speed computers and communications; software tools that help users navigate among the huge array of services available on the computer systems connected by the network; and information appliances, such as telephones, televisions, and multimedia workstations that allow users to access the network. Many of these technologies are being developed under the auspices of the federal interagency High Performance Computing and Communications (HPCC) program (5). Information generated through the various appliances -- whether it relates to patients, restaurants, or water sample data -- is all the same when converted to digital bits for transmission, switching, and processing.

NII technology has great potential for meeting the information needs of population-based public health. The rapid, transparent connectivity of the NII is well suited to facilitate the communication of data, voice, or high-resolution visual images. This not only can improve the speed, reliability and efficiency of keeping people informed, it can also facilitate collaborative management, and support such activities as long-distance learning. The NII can also provide the necessary infrastructure to develop integrated databases, support analyses of these data, and make better use of data. As a gateway, the NII enables a computer in one location, with the appropriate authorization, to query information collected by others, vastly increasing the range of knowledge readily available at a given location. If all of the systems involved in the network collect data using a common vocabulary, aggregating data collected for different purposes becomes practical, and the burden of recoding and resubmitting similar information to fulfill additional requirements is reduced. As geography and communications are removed as barriers, it is thought that the NII will function as a global marketplace to encourage the development and dissemination of a wide variety of affordable information processing services. Some of these services will be image enhancement, data manipulation, and analytic tools. Others will facilitate guided interactions with knowledge bases, through such mechanisms as interactive retrieval and expert systems. While it is clear that the NII has great potential to support data collection and analysis, communication, and decision support for public health, effective use of the technology will be dependent on multiple factors, including the availability of information; uniform standards for data elements and electronic transmission; tailored software that allows users to obtain access to and manipulate health information; policies to protect the privacy and security of information; and a well-trained workforce to create the information, develop applications, construct facilities, and train others to benefit from its potential.

## 6.2 Scenario 2: Multimedia Public Action Campaign Reduces Deaths Due to SIDS

A state public health official is comparing the most recent data on deaths due to sudden infant death syndrome (SIDS) in his state with data that has systematically been added to the state database during the previous year. During that period, the public health department initiated a special campaign to educate hospital officials, health professionals, and new parents on the importance of infant sleep position in reducing SIDS. Working through the Internet, a task force representing health professional groups, managed-care plans, hospitals, public libraries, and community service organizations developed and implemented a comprehensive state-wide plan. Multimedia bulletins were developed and made available through the Internet summarizing the results of research implicating sleep position in SIDS and illustrating correct and incorrect sleep positions.

Long-distance learning programs focusing on sleep position and SIDS were established for health professionals. Modules on sleep position were added to interactive videodiscs prepared for parents taking infants home from the hospital and coming in for well child care visits. The graphically displayed data for the past two years indicate that the campaign has been successful in reducing in-hospital SIDS, even when the appropriate adjustment is made for reductions in the time infants spend in hospitals after birth. In-home SIDS has also been reduced in most parts of the state. Linking the SIDS data to other state-wide information resources, the state public health official explores several possible explanations for the lack of reduction in in-home SIDS in certain jurisdictions, such as language barriers (the SIDS educational material was produced in English and Spanish only), and less frequent visits to clinicians providing reminders. Since the incidence of SIDS is higher in jurisdictions with a lower percentage of immunized babies, this latter explanation seems plausible. The task force is reactivated with additional members from the identified communities to target interventions in these areas.

## 6.3 Scenario 3: On-Line Statistical Displays Make Health Matter for Policymakers

In preparation for a strategic health policy meeting with the governor, the state health official and the governor's chief social services advisor call up the health policy decision support system to generate a number of on-line reports from the state's integrated health information system. Today, they are interested in: (a) the top 25 health problems in the state based on numbers of affected citizens and incurred costs, displayed by age of affected groups, local jurisdictions, and underlying cause of mortality; (b) the health problems that have changed most in terms of number of persons affected, age groups affected, jurisdictions affected or costs incurred over the last 1, 2, 5, and 10 years; (c) the extent to which health problems targeted by the state over the past several years have been ameliorated as measured by the indicators negotiated with Federal health officials; and (d) the number of related deaths and injuries before and after passage of highway speed limits and mandatory helmet laws. They also compare statistics on trauma deaths in their state with trauma deaths in states with state-wide shock/trauma treatment systems. Electronic graphs, charts, and maps of the most significant information are generated and copied for the governor's briefing book.

## 6.4 Scenario 4: In-Home Workstation Helps Family Take Preventive Action

A young working mother of two notices that the message light on her home video/data workstation is on. She calls up her messages and receives a reminder that her son is due for another immunization and can receive it the following Saturday morning at the managed care

Dutch cases. He also informs the state epidemiologist, updates the international database, and sends a priority message to the CDC. The epidemiologist investigating the case determines that the patient recently flew to New Orleans from Amsterdam. She adds this information to the international database and informs CDC.

### 6.7 Scenario 7: National Toxic Release Inventory Aids Local Environmental Impact Analysis

A state public health official is using e-mail to notify colleagues throughout the state about an upcoming videoconference on the relationship between environmental toxins and cancer. She receives a message that the county toxic release inventory database has just been updated with information from TRI94, an NLM database of toxic release data from the U.S. Environmental Protection Agency. Invoking a geographical information system, she looks at the pattern of releases and asks for summary statistics on the trends for the past five years. She asks to view any disease incidence that might correlate with the location of the toxic releases. Although a higher incidence of some cancers appears in the area near the toxic releases, the system indicates that the geographic pattern for the cancers existed prior to the source of the toxic releases.

The latest TRI data indicate that several additional chemicals are now being manufactured and transported in the county. Using other NLM databases, the public health officer reviews information about these chemicals, their environmental impact, and appropriate methods for dealing with people exposed to them. After sending a brief message about the chemicals to involved county HazMat teams, fire and rescue workers, and local health care providers, she updates the county database of potential health hazards with entries for the additional chemicals and specific automated pointers to detailed information on handling, cleanup, and effects of exposure.

### 6.8 Scenario 8: Digital Camera Speeds Diagnosis of Contaminated Well

A county resident with a backyard well complains to the local health department that mud and silt are coming out of the water taps in his house. A local county health inspector comes to take water samples and to inspect the interior of the well. He lowers a portable, waterproof "endoscope" with attached digital camera into the well and sees a break in the well casing about 15 feet down. The well will have to be rebuilt. The onsite inspector needs a second opinion to determine whether the problem is due to faulty installation or some subsequent cause. He sends the digital pictures directly to the state division for wells via a wireless connection to the Internet. NII technology is making cases such as this one less common. A computer search of all state well permits identifies similar wells so that owners can consider corrective action before experiencing them in the kitchen sink. Because the well "endoscope" often can prove substandard construction, contractors have an incentive to build wells right the first time.

### 6.9 Scenario 9: Multimedia Data Transfer Supports Long-Distance Entomology

A university-based entomologist is consulting for the state public health department. She is in her office at the university reviewing a multi-media message from a local public health department at the other end of the state. An insect not included in the on-line database of insects in the region has been discovered in a residential area. The text portion of the message describes the environment in which the insect was found and poses questions about its direct effect on humans and animals and its potential role as a disease vector. The image portion of

## 7.0 HOW IS NII TECHNOLOGY CURRENTLY BEING APPLIED TO POPULATION-BASED PUBLIC HEALTH?

These futuristic scenarios, as well as current real-life applications, leave no doubt that the information needs of population-based public health are well matched with the capabilities of NII technology. Moreover, the federal NII and HPCC initiatives may provide the public health community with an opportunity to obtain funding for projects that apply NII technology to population health. While it is encouraging that a small number of public health applications have been funded through broad-based NII grant programs in the Department of Commerce (DOC) and the Department of Agriculture (USDA), public health participation in these and other broad-based NII and HPCC grant and contract programs has been modest at best. Thus far, the bulk of federal support for population-based health applications has come from PHS programs specifically targeted to the public health community.

### 7.1 Broad-based Federal NII Grant Programs

The bulk of federal funding for the NII initiative and its underlying HPCC technology has been through broad-based programs, not specifically targeted at health applications. Some of these programs, such as the National Institute of Standards and Technology's (NIST) Advanced Technology Program, are not particularly well suited for public health because they are either targeted at for-profit businesses or are intended to promote the development of high-risk technologies. But even when there is a close fit between public health applications and an NII or HPCC program, public health participation to date has been quite variable. For example, of the more than 100 applications received by the NLM in 1993 in response to its Broad Agency Announcement for Proposals for health-related applications of HPCC technology, none came from public health departments and only a few addressed issues related to population-based health.

Of the 31 Distance Learning and Medical Link awards granted by the Rural Electrification Administration (REA) about which we have specific information, five have some public health component. Of the 92 projects funded by the National Telecommunications and Information Agency (NTIA) in 1994 to assist non-profit organizations in improving access to the Internet, six were awarded to public health departments, which is consistent with the small number of applications received from the public health sector. These six projects -- from the Health Department of Oklahoma City/County, the Governor's office and Department of Health in Pennsylvania, the Division of Public Health in Georgia, the Michigan Association for Local Public Health, the Saint Louis University School of Public Health, and the Health Sciences Division of Columbia University - - received substantial financial support. In fact, the partners in the Georgia Information Network for Public Health Officials (INPHO) project received the fifth highest grant award ($660,000) out of 92 NTIA projects funded.

### 7.2 Public Health Service Activities

With the exception of the projects mentioned above, most of the progress that has been made to date in applying NII technology to population-based public health reflects activities that can be viewed as adjuncts to the broad-based NII initiative. Perhaps the most important of these activities -- because it is a prerequisite for moving further -- is the vital role that CDC has played both in connecting public health agencies to the Internet and in providing Internet-based information services specifically designed for public health officials. Below are some specific

improving the ability of computer programs to "understand" the actual meaning of user inquiries and to use this understanding to retrieve and integrate relevant information from many disparate machine-readable information sources (6). The main UMLS database now contains terms for 223,000 health-related concepts from more than 30 source vocabularies. Since it preserves the link between the concepts and terms in the original vocabularies, this Metathesaurus can be used to translate between a user's terminology and the different vocabularies used in different databases. While originally conceived as an information retrieval tool, the UMLS also provides a vehicle for disseminating a detailed and uniform vocabulary for computerized medical records systems. It might also evolve into a standard, multipurpose nomenclature for logically integrated health information systems -- one that could capitalize on information being recorded in computerized medical records and be mapped to multiple classifications, such as ICD-10 for international morbidity and mortality reporting and CPT for physician billing. Work is currently underway to expand the UMLS to include unique public health concepts and to test the "health vocabulary" in both clinical and public health settings.

7.2.3    Agency for Health Care Policy and Research. AHCPR is working to develop uniform, accurate, and automated patient care data as part of its research activities in medical treatment effectiveness, practice guideline development and evaluation, clinical performance measures, medical review criteria, and clinical decision support systems. The Agency is also pursuing various avenues for electronic dissemination of health information to ensure fast and cost-effective availability to large audiences.

A full-text retrieval system, developed with the NLM, provides thousands of users each month with electronic access to guidelines by modem or the Internet. A prototype CD-ROM developed for medical libraries includes all versions of the 15 clinical practice guidelines released to date. The Information Resources Center for health services research, which is part of the national network of libraries of medicine, handles queries online.

AHCPR also works with the National Technical Information Service to make information available in electronic form. These activities include the development of an electronic bulletin board that has become the gateway to FEDWORLD and provides a bibliographic database of AHCPR-funded studies. National health survey data is available to users through a variety of data products (magnetic tape, PC diskettes, and CD-ROM).

AHCPR has partnered with managed care organizations and professional associations to incorporate clinical practice guidelines in various computer information systems, online retrieval services, and CD-ROM products for health care providers. Consumer health information is available through electronic kiosk projects and online information services.

7.2.4    Centers for Disease Control and Prevention. CDC has worked on several fronts over the past eight years to strengthen the public health information infrastructure. Building on needs identified in the IOM report "The Future of Public Health", CDC WONDER was developed to organize CDC's wide array of scientific and prevention data and information in a manner accessible to public health practitioners. In addition, an array of automated disease surveillance and large population surveys were developed to facilitate the collection, reporting, and analysis of important population-based health information. Finally, CDC INPHO was developed to provide leadership to state and local public health agencies as they began realizing the vision of the NII.   CDC INPHO is a programmatic effort designed to build an information and communications infrastructure linking the nation's state and local health departments to each